# Chapter VI: Education





"Education is the key to America's economic growth and prosperity and to our ability to compete in the global economy. It is the path to good jobs and higher earning power for Americans. It is necessary for our democracy to work. It fosters the cross-border, cross-cultural collaboration required to solve the most challenging problems of our time."

National Education Technology Plan, U.S. Department of Education

As the U.S. Department of Education recognizes, education is a key factor affecting economic growth, and the development of the knowledge base and technological advances needed to compete in a global economy. Education serves as a vehicle for strengthening the workforce and thus contributes to societal development and ensuring Puerto Rico's future competitiveness in a global market. It is the foundation for setting values and developing the skills and abilities to solve everyday challenges.

The broadband and IT revolution underway has perhaps nowhere greater impact than in the education sector. Broadband and IT has shifted basic education paradigms and is already transforming the way our children and young population learn and grow as well as the way educators facilitate the learning process. The K-16 of the twenty-first century will be markedly different from that of the twentieth century and it will afford new opportunities for its students. That transformation, however, will not take place on its own to ensure that all citizens, regardless of income level, place of dwelling, race, ethnicity or other factors have access to those opportunities.

Broadband-enabled education solutions, properly leveraged through the K-16 system, provide new opportunities to empower educators, parents, and students. Broadband expands teachers' instructional capabilities and boosts students' research and interactive opportunities beyond the confines of the physical classroom and the traditional school. It empowers students to learn and share with individuals beyond traditional circles and facilitates communication between educators and parents, which promotes engaged decision making regarding student needs and abilities. Online course material makes educational attainment more flexible and accessible to more people and can significantly expand the opportunities available to students within their local schools and universities, and help expand options available to students within confined budgetary conditions.

In turn, the expansion of broadband and IT usage across the K-16 system is a key demand driver for IT and broadband technologies. As these students learn through their school experiences the value of IT and online opportunities afforded by this technology, they will become active digital citizens. Today, those same students can help guide their parents and grand-parents on how this technology can impact their lives and livelihood, and help them overcome digital literacy barriers.

# Technology is at the core of virtually every aspect of our daily lives. We must leverage it to provide engaging and powerful learning experiences and content.

The federal and Puerto Rico governments understand this challenge and have recognized that fully leveraging IT and broadband resources across the K-16 educational experiences requires a holistic approach and an ongoing transformational process.

The U.S. National Education Technology Plan (NETP) recognizes that "technology is at the core of virtually every aspect of our daily lives and work, and we must leverage it to provide engaging and powerful learning experiences and content, as well as resources and assessments that measure student achievement in more complete, authentic, and meaningful ways. Technology-based learning and assessment systems will be pivotal in improving student learning and generating data that can be used to continuously improve the education system at all levels. Technology will help us execute collaborative teaching strategies combined with professional learning that better prepare and enhance educators' competencies and expertise over the course of their careers." The NETP presents a holistic approach to drive this transformational process across five intersecting areas:

- i. A new learning paradigm The NETP calls for a review of basic teaching paradigms and asks that we "focus what and how we teach to match what people need to know, how they learn, where and when they will learn, and who needs to learn. It brings state-of-the art technology into learning to enable, motivate, and inspire all students, regardless of background, languages, or disabilities, to achieve. It leverages the power of technology to provide personalized learning and to enable continuous and lifelong learning:"
- ii. Assessment The NEPT calls for the use of "data to drive continuous improvement" of our education practices;
- iii. Teaching The NEPT recognizes that to fully achieve this transformation, teachers need to be supported in learning how to use the technology to help their students achieve success and calls for "using technology to help build the capacity of educators by enabling a shift to a model of connected teaching. In such a teaching model, teams of connected educators replace solo practitioners, classrooms are fully connected to provide educators with 24/7 access to data and analytic tools, and educators have access to resources that help them act on the insights the data provide;"
- iv. Infrastructure The NEPT recognizes that "an essential component of the learning model is a comprehensive infrastructure for learning that provides every student, educator, and level of our education system with the resources they need when and where they are needed. The underlying principle is that infrastructure includes people, processes, learning resources, policies, and sustainable models for continuous improvement in addition to broadband connectivity, servers, software, management systems, and administration tools. Building this infrastructure is a far-reaching project that will demand concerted and coordinated effort."

## The Department of Education Technology Plan aims to ensure that students and teachers will be technologically literate and able to use technology tools.

v. Productivity – The NEPT understands that to "achieve our goal of transforming American education, we must rethink basic assumptions and redesign our education system. We must apply technology to implement personalized learning and ensure that students are making appropriate progress through our P–16 system so they graduate."<sup>3</sup>

Building upon the U.S. National Education Technology Plan, the Puerto Rico Department of Education's Technology Plan of 2010 (PRETP) sets in motion a holistic approach to jump-start this transformation across the island.<sup>4</sup> The PRETP's stated goal "ensures that students and teachers will be technologically literate and able to use technology tools to expand and improve the teaching and learning processes." The role of technology in education is summarized as follows:

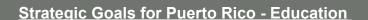
"By providing optimal conditions, such as a curriculum wholly permeated by crosswise integration of technology; on-going, sustained and intensive professional development; effective parental and community involvement in the educational process, access to technological educational resources, and decision making based on tangible data, students will be able to use technology effectively and ethically in learning, creating, solving problems, doing research, making decisions and communicating, thus taking on the responsibility of their own learning." 5

To achieve this vision, the PRETP is structured around five key areas, including: "integration of technology in the curriculum, professional development, providing a technology-rich learning environment and support, community and parent involvement, data-driven decision making and accountability." <sup>6</sup>

The Puerto Rico Broadband Taskforce embraces the federal and Puerto Rico visions for a twenty-first century K-16 education and strongly supports efforts at the federal and local levels to

continue testing new ideas and developing new models that enable this transformation. Building upon this work, as well as upon the research conducted by the Federal Communications Commission (FCC) in its 2010 National Broadband Plan review of the challenges faced in the education sector as ICT opens new opportunities,<sup>7</sup> the Puerto Rico Broadband Taskforce calls for a holistic approach across Puerto Rico for the expansion of broadband and IT in the education sector that includes the following goals:





All K-16 institutions will have sufficient broadband capacity available to sustain always-on learning opportunities in every school, teacher's and administrator's office, classroom, and on each student's desk and backpack.

To enable this vision:

- Every K-16 institution should have access to 100 Mbps speed by 2015 and 1 Gbps speed by 2020.
- All students will have the means to access always-on online learning opportunities in and outside of the classroom. To enable this vision, all students will need to have wireless devices that are fast, robust, and safe and that can support the student's learning experience beyond the classroom.
- A technology curriculum will be developed for every stage of the K-16 learning experience that is adjusted to the changing technology environment and ensures students are developing the necessary ITliteracy skills to fully leverage online resources in a safe environment.
- Continued development of a teaching work force that has the necessary skills to fully leverage broadband and IT technology in and outside of the classroom.

This chapter reviews existing data to assess to what extent Puerto Rico meets these goals today, and proposes a series of recommendations aimed at complementing ongoing work of the Puerto Rico Department of Education.

## B. Broadband and Education Across Puerto Rico

## 1. Broadband Connectivity Across Puerto Rico K-12 Public Schools

In 2011, the broadband capacity under contract for Puerto Rico public schools was drastically below the connectivity goals stated by the FCC's National Broadband Plan, and fell well short of the capacity goals recommended by the PRBT, namely: access to 100 Mbps download capacity by 2015, and 1 Gbps by 2020. In all but one of the seven school regions of Puerto Rico, the median broadband capacity contract across all public schools in 2011 was 512 Kbps download and 1.5 Mbps upload maximum speeds. In the region of Arecibo broadband contracts tend to offer a more symmetric download/upload service, but are still drastically below stated goals (Table VI.1).

# The broadband capacity under contract across Puerto Rico public schools is drastically insufficient to meet the school connectivity goals of 1 Gbps.

Table VI.1 - Broadband Service Across Puerto Rico Public Schools - By School Region							
School Region	Total Number of Schools	Percentage of Rural Schools	Percentage of Schools Served by DSL	Percentage of Schools Served by Frame Relay	Percentage of Schools Served by Other Platform	Median Broadband Download Speed Contracted	Median Broadband Upload Speed Contracted
Arecibo	202	63.4%	48.5%	50%	1.5%	1.5 Mbps	1.5 Mbps
Bayamon	192	45.8%	65.1%	34.9%	0%	512 Kbps	1.5 Mbps
Caguas	227	56.8%	67%	32.6%	0.4%	512 Kbps	1.5 Mbps
Humacao	209	61.2%	63.6%	35.9%	0.5%	512 Kbps	1.5 Mbps
Mayaguez	234	63.5%	62%	37.6%	0.4%	512 Kbps	1.5 Mbps
Ponce	234	54.7%	55.1%	44.4%	0.4%	512 Kbps	1.5 Mbps
San Juan	218	19.3%	83.9%	16.1%	0%	512 Kbps	1.5 Mbps

Source: Puerto Rico Department of Education, 2011.

None of the public schools in Puerto Rico were served by fiber-optic networks, the only technology today able to sustain symmetric broadband capacity of 1 Gbps, or even 100 Mbps. The technology platform most commonly used to provide broadband services across Puerto Rico public schools is DSL service and frame relay service. Both of these technologies are woefully inadequate to sustain the broadband connectivity vision laid out by the National Education Technology Plan where, ultimately, every administrator, every teacher, every classroom, and every student will have direct access to a safe online experience. This school capacity gap is endemic across the island and affects both rural and urban schools.

To address this from the policy perspective, we need to understand what drives this low broadband connectivity across Puerto Rico's public schools. Is it lack of faster broadband connectivity? Or is the broadband there, but not being leveraged?

Table VI.2 provides some insights into these questions. Contrasting the school connectivity information with Connect Puerto Rico's broadband inventory data available to residential customers across each municipality, suggests that there are municipalities where broadband is available at speeds as high as 10 Mbps, yet schools in those areas are not taking advantage of this opportunity. In short, while lack of high-capacity broadband backhaul infrastructure remains a key barrier to achieve more robust connectivity for schools across some parts of Puerto Rico, the challenge in Puerto Rico is not solely one of broadband inventory capacity. Many public schools are not contracting faster broadband capacity even when available.

Table VI.2 - Broadband Service Across Puerto Rico Public Schools - By Municipality						
Municipality	School Region	Number of Schools	Median Contract Download Speed	Median Contract Upload Speed	Highest Broadband Speed Available - Residential Market*	Median Household Income
Adjuntas	Ponce	12	1.5 Mbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$11,983
Aguada	Mayaguez	21	1.5 Mbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$14,103
Aguadilla	Mayaguez	25	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up 0.4%	\$13,956
Aguas Buenas	Caguas	18	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$14,751
Aibonito	Caguas	14	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$15,487
Anasco	Mayaguez	12	1 Mbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$15,244
Arecibo	Arecibo	34	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$16,564
Arroyo	Caguas	10	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$14,815
Barceloneta	Arecibo	12	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$16,124
Barranquitas	Caguas	16	1Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$14,751
Bayamon	Bayamon	68	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$25,294
Cabo Rojo	Mayaguez	16	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$15,809
Caguas	Caguas	39	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$22,951
Camuy	Arecibo	15	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$14,985
Canovanas	Humacao	16	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$21,934
Carolina	San Juan	45	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$28,262
Catano	Bayamon	13	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$18,144
Cayey	Caguas	23	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$19,040
Ceiba	Humacao	10	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$18,461
Ciales	Arecibo	13	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$13,564
Cidra	Caguas	20	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$21,293
Coamo	Ponce	19	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$15,028
Comerio	Caguas	16	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$12,927
Corozal	Bayamon	15	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$14,077
Culebra	Humacao	2	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$19,868
Dorado	Arecibo	12	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$25,473
Fajardo	Humacao	9	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$19,803
Florida	Arecibo	12	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$16,246
Guanica	Ponce	12	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$11,870
Guayama	Caguas	24	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$17,214
Guayanilla	Ponce	11	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$14,243
Guaynabo	San Juan	23	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$33,279
Gurabo	Caguas	16	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$27,416
Hatillo	Arecibo	15	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$16,246
Hormigueros	Mayaguez	21	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$19,834
Humacao	Humacao	24	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$18,354
Isabela	Mayaguez	19	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$13,028
Jayuya	Ponce	14	1.5 Mbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$15,556
Juana Diaz	Ponce	21	1.5 Mbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$16,496
Juncos	Humacao	15	512 Kbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$17,694
Lajas	Mayaguez	12	512 Kbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$14,500
Lares	Arecibo	18	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$12,199
Las Marias	Mayaguez	8	1.5 Mbps	1.5 Mbps	768 Kbps down/200 Kbps up	\$13,847
Las Piedras	Humacao	18	1.5 Mbps	1.5 Mbps	10 Mbps down/768 Kbps up	\$17,680



<sup>\*</sup> Residential broadband inventory includes all terrestrial platforms except for mobile service.

Source: Public school broadband connectivity, Puerto Rico Department of Education, 2011. Residential broadband capacity, Connect Puerto Rico, June 2011. Median household income, American Community Survey, 5 year estimates, 2006-2010.

# The percentage of Puerto Rico residents who access online education (38%) resources is significantly lower than the Connected Nation average (52%).

### 2. The Education Digital Gap In Puerto Rico

To fully achieve the benefits of broadband and IT in the education sector, it is necessary that each K-16 student has 24/7 robust and safe online educational resources. Achieving universal, robust and safe access for each student and teacher within the confines of the school, community college, or university is not enough. The educational paradigm of the twenty-first century calls for an always-on, much broader access to online educational resources and experiences, which must include access in the home.<sup>8</sup>

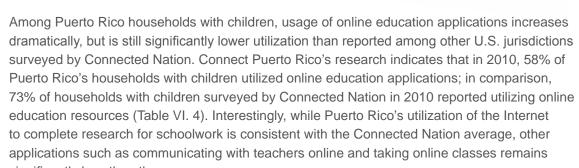
To meet the education technology goals, all households must have access to broadband and the willingness and necessary tools and knowledge to connect to a broadband network from their homes, or from mobile devices. As has been described in detail in Chapter III of this Strategic Plan, the digital gap across the Puerto Rico residential market is acute. In 2010, only 31% of all Puerto Rico households subscribed to a broadband service, representing a significant lag with other developed nations. Further, the average speed of these residential subscriptions is relatively slow and insufficient to meet the increasing demand for broadband capacity driven by the ever-increasing expansion of bandwidth-intensive online applications.<sup>9</sup>

As online education applications rapidly extend educational opportunities outside of the classroom, a vicious cycle expanding the gap across the digital have- and have-nots is exacerbated. Students with access to broadband at home may develop an advantage over those students who can only access these resources at their public schools and libraries, furthering the effects of the digital divide. Data indicates that the residential digital gap across Puerto Rico is already driving this vicious cycle.

According to Connect Puerto Rico's 2010 Residential Technology Assessment,<sup>10</sup> 38% of Puerto Rico's residents utilize online education applications; a percentage that is significantly less than the 52% average reported by residents living in jurisdictions surveyed by Connected Nation.<sup>11</sup>

In Puerto Rico, this includes 36% of residents who used the Internet to conduct research for schoolwork, 12% of residents who utilized the Internet to communicate with teachers, and 7% who pursued online classes (Table VI. 3).

Table VI.3 - Percentage of All Residents who Utilize Online Education Applications			
Among all residents	Connected Nation Average	Puerto Rico Average	
Use any e-Education application	52%	38%	
Research for schoolwork	39%	36%	
Communicate with teachers	32%	12%	
Take online classes	20%	7%	



significantly less than the
Connected Nation average.
For example, more than
one-quarter of households
with children (27%) located
in jurisdictions surveyed by
Connected Nation report taking
classes online; while only 8% of
Puerto Rico's households with
children report doing so.

Table VI.4 - Percentage of Households with Children who Utilize Online Education Applications				
Among households with children	Connected Nation Average	Puerto Rico Average		
Use any e-Education application	73%	58%		
Research for schoolwork	58%	55%		
Communicate with teachers	50%	12%		
Take online classes	27%	8%		

This gap is not solely driven by Puerto Rico's lower residential broadband adoption rates. Analysis of broadband-connected households delivers interesting results. When compared to the Connected Nation average, broadband-connected households in Puerto Rico are actually more likely to utilize the Internet to complete research for schoolwork (Table VI.5). However, broadband-connected households are significantly less likely to communicate with their teachers or take online classes. These findings could suggest that, rather than Puerto Rico's residents being hesitant to adopt and utilize online education resources, instead, Puerto Rico educational institutions are lagging in their offering of online content and applications. For example, students with a home broadband subscription do not rely on a Puerto Rico based education provider

for online research tools, as these services are provided by numerous web-based services. However, services that would commonly be delivered by Puerto Rico based educational institutions (online classes or teacher-parent and teacher-student communication) are not being offered.

Table VI.5 - Percentage of Broadband-Connected Households who Utilize Online Education Applications				
Among broadband-connected households	Connected Nation Average	Puerto Rico Average		
Use any e-Education application	65%	64%		
Research for schoolwork	49%	60%		
Communicate with teachers	42%	22%		
Take online classes	26%	16%		



by Connected Nation report utilizing an e-Education application (including 57% who communicate with teachers and 31% who take online classes), only 68% of similar households in Puerto Rico report doing so (including 16% who communicate with teachers and 13% who take online classes) (Figure VI.6).

Online Education Applications					
Among broadband-connected households with children	Connected Nation Average	Puerto Rico Average			
Use any e-Education application	80%	68%			
Research for schoolwork	63%	62%			
Communicate with teachers	57%	16%			
Take online classes	31%	13%			

Table VI.6 - Percentage of Broadband-Connected

Broadband can be an important tool to help educators, parents, and students meet major challenges in education. Such opportunities will be fully leveraged only if all parents and students have the capacity, knowledge, and willingness to connect to broadband in their homes. If the digital gap is not closed, Puerto Rico's education system may be at risk of falling behind. Chapter V of this Strategic Plan discusses in depth the broadband adoption gap across Puerto Rico and proposes a series of recommendations to help close this gap. Such efforts must be built in coordination and collaboration with efforts to close the digital gap across Puerto Rico K-16 educational institutions.

## 3. Educational Technology Reforms Underway

Recognizing the importance of investment in education, the Government of Puerto Rico has launched an aggressive plan to modernize the island's public schools through the 21st Century Initiative. This initiative is a comprehensive, island-wide school modernization program that is investing \$756 million to transform over 100 public schools to benefit students, parents, educators, and communities. The initiative is based on a unique public-private partnership to leverage the government's investment in creating a modern school environment and a better educational model - improving the lives of tens of thousands of students and teachers in the process. This 21st Century Initiative is one key step necessary to address the challenges of a modern, twenty-first century education system. These structural reforms are complemented through multiple efforts across the Department of Education, higher-education community, and private stakeholders to tackle concomitant reform challenges necessary to fully leverage broadband and ICT to empower our children for a better future.



#### a. Reforming K-12 Educational Technology Usage in Puerto Rico

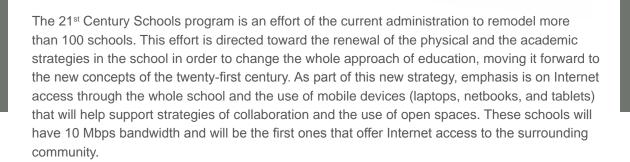
At the K-12 level, the Puerto Rican government is currently developing and implementing plans to provide resources for:

- The integration of technology into the curriculum,
- An assurance of continuous professional development opportunities for teachers,
- Offering parental and community involvement and capacitation on matters related to technology so that they are digital citizens,
- Providing greater access to technological resources in all schools, every classroom, and for each student in the system,
- Assuring that students are critical thinkers capable of using technology in a creative and responsible manner for problem solving.

The Puerto Rico Department of Education (PRDE) has been developing and implementing a series of initiatives and projects directed to two major objectives: Reinforce and revamp the technology infrastructure in schools and all the dependencies of the agency and promote the integration of technology to the curriculum through the continuous training of teachers and administrative personnel and the provision of access to technology to teachers, students, and their parents.

The Internet service and maintenance of the network infrastructure is included in the PRDE 2012 eRate funding application. This federal program pays up to 90% of the total Internet and telephone services, basic maintenance of network infrastructure, and internal connections required for schools. The PRDE has developed a plan to gradually expand the Internet bandwidth of all the schools in Puerto Rico. In 2012, a total of 692 schools will be upgraded to 3 Mbps. These schools were selected based on the usage demonstrated in the monitoring reports and their inclusion in academic integration projects.

Moreover, in 750 schools up to three classrooms with 25 computers will be connected with a terminal server that will enable teachers and students to access materials and information and participate in collaborative projects with students from others schools in Puerto Rico and around the globe. Access to other areas of these schools will be granted through the installation of additional drops and access points. Through the eRate application the remaining schools will be included in a similar effort. These schools will be able to take advantage of projects like the Intel Teach Program, Operación Éxito, and other important initiatives designed to enhance the academic achievement of students. This effort will also help maximize the Electronic Libraries Initiatives that is already implemented in more than 167 schools around the island.



On the other hand, the Technology and Curriculum Unit is in charge of the initiatives in the Department of Education that integrate the use of technology into the curriculum and instruction in order to improve and enhance efforts toward academic achievement and accountability. These efforts are expected to ensure the implementation of powerful instructional practices in the delivery of course content, assessment, and state standards and expectations. Some of these projects include:

- CeL (Cursos en Línea / Online Courses) CeL is an innovative project that offers distance courses in various subject matters to students from 10th to 12th grade.
- CITeD (Centros de Innovaciones Tecnológicas para la Docencia / Technology Innovation Centers for Educators) – These centers provide support in areas related to the use of technology in the educational process.
- CENIT (Centro de Iniciativas Tecnológicas / Technological Initiative Centers) These centers
  contribute to the development of the infrastructure and the academic content areas through
  professional development activities and the provision of technological resources.
- EE (Editorial Electrónica / Electronic Press) Creates and develops multimedia productions to satisfy the need for reference materials to supplement and enrich the curriculum.
- TEEE (La Televisión como Estrategia Educativa Efectiva / Use of the television as Effective Educational Strategy) – This strategy integrates the use of the television as a resource to enhance the teaching learning process.
- PVAD (Plataforma Virtual de Alfabetización Digital / Digital Literacy Virtual Platform) The
  primary purpose of this initiative is to develop competencies related to digital literacy in
  teachers and 8th grade students as required by federal mandate.

#### b. The Role of Higher Education

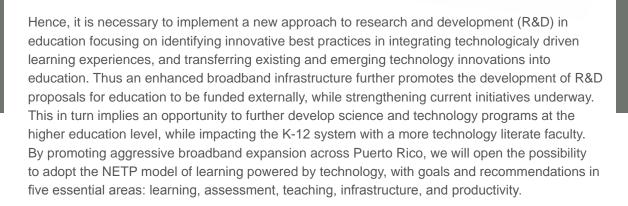
Higher education is to be viewed as a focal point impacting all facets of the development of digital literacy. It is the role of higher education institutions to provide students, alumnae, and faculty with effective access to technological information resources and training to strengthen their information competencies.

Higher education trains the future work force of Puerto Rico, offering training on discipline-specific technological knowledge. It is through higher education that teacher candidates are trained; it is the teacher candidates who will go on to educate K-12 students as digital users and serve as facilitators for parent and community literacy on technological matters. At the same time, higher education institutions serve as providers of professional development initiatives related to information technology for current teachers. Many higher education systems make use of their community service initiatives to offer their surrounding communities technological centers and develop activities geared at achieving an increased awareness of the need for digital citizenship. Finally, universities offer access to the Internet across their campuses to assure that learning through technology surpasses the physical limits of the classroom. Thus, it is necessary to provide broadband access for all research centers, meeting and study areas, libraries, and laboratories. Finally, it is through the higher education system that continuous technological knowledge and advances are achieved (Figure VI.1).

Figure VI.1 - Higher Education's Impact

on Developing an Information Literate Community **Future** Workforce Training Technological Teacher Research and Candidate Development **Training** Higher Education Community Professional Service Development Programs on for Teachers Information Literacy

Puerto Rico Broadband Strategic Plan



#### c. Reform of Teacher Accreditation

Higher education in Puerto Rico is regulated by the accreditation of the Middle States Commission on Higher Education (MSCHE). To comply with accreditation requirements, institutions must meet 14 standards of various natures, many of which emphasize technology integration to the curriculum.

Specifically, accreditation requirements on technology include:

- Assurance that, upon degree completion, students are proficient in technological competencies appropriate to their discipline.
- Evidence that institutions have articulated expectations of student learning outcomes for information literacy and technological competence.
- Evidence that institutional support resources include the necessary technological infrastructure for instruction, the delivery of optimal student support services, and administrative processes.
- Evidence that institutions are providing learning opportunities that afford students with the ability to understand the economic, legal, and social issues surrounding the use of information and information technology (i.e., digital citizenship).
- Evidence that institutions are providing both students and instructors with the knowledge, skills, and tools needed to use the information, new technology, and media for their studies, teaching, or research.
- Evidence that institutions are offering periodic updating or retraining as information technologies emerge.

The integration of technology for instruction and assessment is also a key element of the requirements outlined by the National Council on the Accreditation of Teacher Education (NCATE). It is the accrediting agency's expectation that institutions that offer Teacher Preparation Programs are committed to preparing candidates who are able to use educational technology. As such they must provide the necessary instruction and assess students' knowledge, skills, and dispositions for integrating technology in their practice and facilitate student learning through the integration of technology. It is also required that the field experiences offered at K-12 schools have the necessary infrastructure so that candidates can use technology to support teaching and learning. Faculty offering instruction to teacher candidates must also be technologically literate and integrate technology into their own teaching. Finally, it is expected that Teacher Preparation Programs have adequate information technology resources to support both their faculty and candidates.

All of the aforementioned technological requirements for the K-16 environment rely primarily on fast and reliable broadband access. The Puerto Rican K-16 education system needs to be revamped by the broadband-enabled learning revolution to meet its responsibilities along with accreditation requirements. By doing so, the children, college students, community, and professionals seeking development experiences, can benefit from the advantages afforded by

advances such as the use of digital textbooks. This is an opportunity to acquire knowledge through lessons personalized to students' learning styles and aptitudes while offering real-time data and feedback to parents and teachers. By immersing the people of Puerto Rico in this technology agenda, teachers, students, parents, and the community at large will not only have state-of-the-art technology at school, but they will have access at the community and at home. What does this mean? That access to digital literacy will not be limited to the classroom, it will be present in every aspect of a learner's life, thus reinforcing continuous learning.





# C. Policy Recommendations to Accelerate Adoption and Usage of Broadband and ICT Solutions In Education

1. Promote a Collaborative Effort Across Government Agencies and Private Stakeholders

Making the vision of the National and Puerto Rico Education Technology Plans a reality will take time, many iterative stages, and involve multiple Puerto Rico government agencies, private stakeholders, and coordination with federal agencies. Implementing this vision includes reforms in teacher accreditation plans, revisions of K-16 technology curriculum, a complete reevaluation of the role of the textbook in the learning process, development of electronic curricula and content, a revamping of electricity and broadband infrastructure across all schools to ensure a level of connectivity, energy backup sufficient to meet the IT needs of the twenty-first century school, innovative approaches to ensure that all students have adequate devices to access all of these resources, etc.

The challenge is great; the opportunity even greater.

Leading this process in Puerto Rico is the Department of Education and the process set in place in its Education Technology Plan of 2010. Other government agencies are part of this process, as well as private stakeholders, including the broadband provider community and companies in the IT sector across Puerto Rico. The Puerto Rico Broadband Taskforce extends a collaborative hand to the Department of Education as it implements this program. Specifically, the Puerto Rico Broadband Taskforce can support this initiative by helping coordinate and plan for the expansion of broadband capacity supporting our schools' IT needs.

#### Recommendation:

Promote a collaborative effort across government agencies and private stakeholders



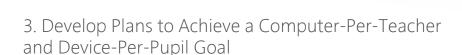
2. Leverage the Demand for Broadband Across Education Institutions to Promote Competition and Investment in Broadband Service

Demand for broadband capacity across the approximately 1,500 public schools and higher-education institutions in Puerto Rico constitutes a key segment of the overall demand for broadband across Puerto Rico community anchor institutions. The purchasing power of this collective, managed by the Department of Education, should be leveraged to help promote greater competition in the broadband market and drive increased investment in backhaul and last mile broadband capacity.

For example, where broadband capacity is lacking at the local level, school districts should be empowered to seek partnerships with other local high-capacity demand institutions, including local civic leaders, government entities, public safety agencies, libraries, hospital or clinics, in a coordinated effort to aggregate local demand needs for increased broadband capacity and service. By aggregating demand within a local community, these institutions will be able to demonstrate to interested broadband providers existing pent-up demand and help justify private investments to bring greater capacity backhaul service to that community. That increased backhaul capacity can in turn benefit the whole community.

#### Recommendation:

Leverage the demand for broadband across education institutions to promote competition and investment in broadband services



These devices should have appropriate software and resources for research, communication, multimedia content creation, and collaboration for use in and out of school. This goal, set forth by the National Education Technology Plan, presents a great challenge for Puerto Rico. As Chapter III of this Strategic Plan documents, with only 31% of homes subscribing to broadband in 2010, the residential broadband adoption rate in Puerto Rico is significantly lagging behind many other developed economies, including all states across the U.S. According to research conducted by Connect Puerto Rico, an estimated 443,000 children in Puerto Rico do not have access to broadband in the home. The challenge set forth by the NETP is, hence, all the more necessary in Puerto Rico. Key aspects that need to be addressed to meet this challenge are the financial constraints of many Puerto Rico families who today live under the poverty level, and will not be able to afford the necessary equipment to achieve these goals.

There are numerous initiatives at the U.S. federal level to help overcome this challenge. The FCC's Learning On-The-Go pilot program of 2011 is testing a model whereby the FCC funds a broadband-enabled device (a computer or tablet) for each student, connected to the Internet via a secure school portal.<sup>13</sup> With this pilot program, currently underway across 20 schools in the U.S., the FCC hopes to develop policies that will help achieve this goal. Similarly, the U.S. Department of Education is assessing plans to make this goal viable.

Puerto Rico stakeholders, including the Department of Education, the ICT community, and the Broadband Taskforce, should work together to assess this challenge across Puerto Rico and develop plans to complement federal initiatives.

#### Recommendation:

Develop plans to achieve a computer-per-teacher and device-per-pupil goal



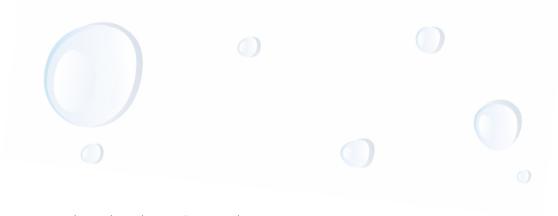
# 4. Ensure K-16 Institutions Have Appropriate Legal and Procedural Frameworks to Perform Effective Network Management

The integration of a successful technology plan throughout any academic scenario opens a myriad of possibilities to strengthen learning by access to greater information resources, new learning modalities, and ample opportunities for enriching the cultural and global knowledge base of a community. Just as well, it sets forth a challenge to academic institutions offering open access to all students, teachers, and administrators. Information technology administrators need to balance the desire for access and peer-to-peer connectivity with available bandwidth constraints, the need to assure academic integrity, and ensuring that copyright laws are respected.

The Higher Education Opportunity Act (HEOA) of 2008, effective as of July 1, 2010, set forth several regulations regarding unauthorized sharing on institutional networks. <sup>14</sup> This implies that institutions of higher education are to develop and implement technological plans that effectively dissuade the "unauthorized distribution of copyrighted material" by users through the implementation of technological deterrents. Specifically, institutions must develop written policies that are periodically assessed. While providing for the authority of each institution to determine the manner and content of said policies, each must contemplate the following "technology-based deterrents": bandwidth shaping, identification of the largest bandwidth users, programs that respond to the Digital Millennium Copyright Act (DMCA). Care must be taken to guarantee that regulations include actions to be taken against those who violate institutional dispositions, and that when policies are approved they are amply distributed among the student population.

#### Recommendation:

Ensure K-16 institutions have appropriate legal and procedural frameworks to perform effective network management



## 5. Digital Technology Curricula

In order to improve and enhance efforts toward academic achievement and accountability, the Department of Education's Technology and Curriculum Unit is working to integrate the use of technology into the curriculum and instruction of the K-12 system. These efforts are essential to ensure that teachers and students have the tools necessary to fully leverage online resources to enhance the educational experience and that students graduate with the necessary knowledge to succeed in the twenty-first century economy. This reform should aim to achieve an enhanced Digital Technology Curricula that leverages the wealth of online content development by nonfor-profits and private corporations alike. Particular emphasis should be given to the integration of technology in the curricula and learning tools of STEM programs, ensuring they are available in both Spanish and English. These efforts should also assess the possibility of using Puerto Rico as a testing ground for models that use online resources to enhance inclusion of Hispanic students in the education system.

#### Recommendation:

Continue integrating the use of technology into the curriculum and instruction of the K-12 system, with particular emphasis given to STEM, bilingual programs

## 6. Expand Resources to Train the Teacher

The Puerto Rico Education Technology Plan of 2010 sets forth accelerated plans to expand resources to train Puerto Rico teachers the necessary digital literacy skills and educational strategies to fully leverage the opportunities offered by online learning. It is imperative that this process continues at a fast rate giving all Puerto Rico teachers an opportunity to benefit from this transformation. We can achieve broadband connectivity at all schools at great capacity of 100 Mbps or 1 Gbps, but if teachers don't have the technical knowledge and educational vision to know how to use these resources, Puerto Rico students will not be able to reap the benefits of this opportunity. To achieve this goal it is imperative to continue revising, creating, and implementing standards and learning objectives using technology for all content areas.

#### Recommendation:

Expand resources to train the teacher to ensure they are able to fully leverage ICT solutions in the classroom



# 7. Launch Pilot Programs to Assess the Efficacy of Online Education Modules

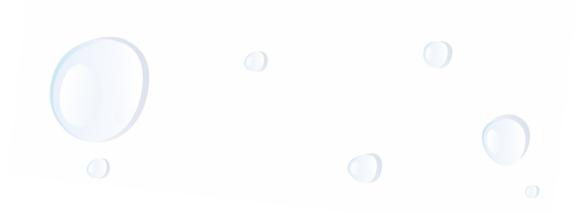
Will online education modules be effective for all subject matters? Is it appropriate at all age levels or only once students reach a certain maturity? How should we leverage the plethora of existing, free or low cost educational and tracking resources available online today for both teachers and students? Examples of such content abound and include the Khan Academy curricula, Intel Corporation's educational content, and many more. What other resources will be needed? Are there lessons to be learned from existing higher-education online courses that can be applied to the high school or below experience? How can higher-education institutions help expand these resources within K-12? These and many other questions need to be assessed in order to effectively leverage online training and courses in the K-12 system. Pilot programs can bring together appropriate stakeholders to assess these questions and ultimately accelerate expansion of these new educational opportunities.

#### Recommendation:

Launch pilot programs to assess the efficacy of online education modules







- <sup>1</sup> U.S. Department of Education, (2010). *National education technology plan 2010*. Retrieved from website: <a href="http://www.ed.gov/sites/default/files/netp2010.pdf">http://www.ed.gov/sites/default/files/netp2010.pdf</a>
- <sup>2</sup> Ibid.
- <sup>3</sup> Ibid.
- <sup>4</sup> Puerto Rico Department of Education, (2010). *Commonwealth of Puerto Rico department of education technology plan,* 2010-2014.
- <sup>5</sup> Ibid.
- <sup>6</sup> Ibid.
- Federal Communications Commission. (2010). National Broadband Plan. Retrieved from website: <a href="http://www.broadband.gov/plan/11-education/">http://www.broadband.gov/plan/11-education/</a>
- 8 Ibid.
- <sup>9</sup> See Chapter 3 for a detailed analysis of the digital gap across the residential sector in Puerto Rico.
- <sup>10</sup> For full results: Connect Puerto Rico, (2010). *Connect Puerto Rico residential technology assessment results*. Retrieved from website: <a href="http://www.connectpr.org/sites/default/files/connected-nation/Puerto Rico/files/PR\_RTA\_2010Q1\_FINAL.PDF">http://www.connectpr.org/sites/default/files/connected-nation/Puerto Rico/files/PR\_RTA\_2010Q1\_FINAL.PDF</a>
- <sup>11</sup> In 2010, Connected Nation conducted random digit dial (RDD) telephone surveys of 15,647 adults age 18 and older across thirteen jurisdictions, including Alaska, Florida, Illinois, Iowa, Kansas, Michigan, Minnesota, Nevada, Ohio, Puerto Rico, South Carolina, Tennessee, and Texas.
- <sup>12</sup> [Web log message]. (2011, September 29). Retrieved from <a href="http://www.connectpr.org/es/blog/post/over-443000-children-puerto-rico-lack-access-broadband-internet">http://www.connectpr.org/es/blog/post/over-443000-children-puerto-rico-lack-access-broadband-internet</a>
- <sup>13</sup> Federal Communications Commission, (2011). *E-rate deployed ubiquitously 2011 pilot program*. Retrieved from website: <a href="http://www.fundsforlearning.com/docs/2011/07/DA-11-1181A1.pdf">http://www.fundsforlearning.com/docs/2011/07/DA-11-1181A1.pdf</a>
- <sup>14</sup> EDUCAUSE, (2010). *Higher education opportunity act.* Retrieved from website: <a href="http://www.educause.edu/Resources/">http://www.educause.edu/Resources/</a> Browse/HEOA/34600



# Chapter VII: e-Health





A key goal of the Puerto Rico Broadband Taskforce is to ensure that Puerto Rico's broadband infrastructure is ubiquitous and offers ample capacity to meet the needs of applications and use patterns of all citizens, businesses, and institutions. Today, a key industry increasingly using broadband and information technology to effectively deliver services is the Healthcare sector. The Puerto Rico Broadband Taskforce is committed to ensuring that all Healthcare sector stakeholders, including healthcare institutions, doctors, pharmacists, clinical laboratory and diagnostic facilities, public or private major financial contributors and, last but not least, Puerto Rico patients, have access to and are effectively using broadband and Health IT solutions; resulting in more cost-effective care services, and greater patient information about their healthcare experience. The goal of this chapter is to assess the broadband needs of the Healthcare sector, and the state of the broadband infrastructure currently available to meet these needs. Armed with this information, the Plan aims to identify the gap remaining across Puerto Rico to meet this challenge, and to propose solutions to work to close this broadband gap across the island.

To accomplish these goals, the Puerto Rico Broadband Taskforce has partnered with the Puerto Rico Health Information Network (PRHIN), which is represented in the Puerto Rico Broadband Taskorce Healthcare Services Committee. PRHIN is a public, private partnership comprised of multiple stakeholders in the Healthcare sector including the Department of Health of Puerto Rico, and representatives of doctors, hospitals, pharmacies, clinics and, importantly, patients. PRHIN has been working since 2010 to develop the necessary tools through the Federal Health Information Exchange (HIE) project to ensure the effective and safe management of health information records among Puerto Rico stakeholders.<sup>1</sup>

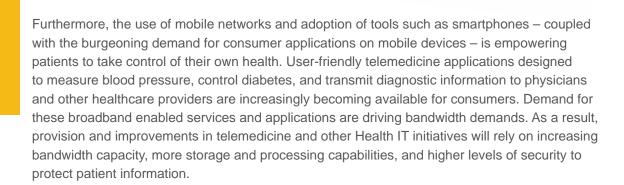
The PRHIN includes the Health IT Regional Extension Center (REC) of Puerto Rico and the US Virgin Islands, which aims to provide accessible and effective solutions, technical resources, and educational programs to facilitate the transformation of primary care practices in Puerto Rico and US Virgin Islands (USVI) through the adoption and meaningful use of health information technology. A key goal of this program is to support and accelerate healthcare providers' efforts to become meaningful users of Electronic Health Records (EHR).

# Health IT refers to a set of broadbandenabled solutions that offer the potential to improve the overall quality, safety, and efficiency of healthcare delivery.

The PRHIN and the REC of Puerto Rico are part of a nationwide effort to identify and overcome challenges to the expansion of health information solutions that are inherent to the Healthcare sector. The goal is to ensure that healthcare providers and the patients they serve are fully leveraging the benefits of health information technology that broadband technology is increasingly providing. As discussed in detail below, the PRHIN is part of a nationwide initiative aimed to trigger the necessary transformations within the Healthcare sector to achieve this reality. This Strategic Plan complements the work that Puerto Rico and U.S. healthcare provider stakeholders are undertaking by addressing a critical piece of the puzzle: ensuring that all healthcare providers and the patients they serve have access to broadband that meets the capacity, latency, and quality of service specifications necessary to utilize Health IT effectively.

This Strategic Plan is aligned with the goals and strategies identified in PRHIN Strategic Plan. It complements that Plan by focusing on the measuring and building strategies to close the broadband infrastructure gap affecting the Healthcare sector across Puerto Rico.<sup>2</sup> This e-Health strategy also builds upon the work of the Federal Communications Commission (FCC). In its 2010 National Broadband Plan, the FCC recognizes the importance of Health IT in helping deliver improved and more cost-effective healthcare services "by dramatically improving the collection, presentation and exchange of healthcare information, and by providing clinicians and consumers the tools to transform care. Technology cannot heal, but when appropriately incorporated into care, technology can help healthcare professionals and consumers make better decisions, become more efficient, engage in innovation and understand both individual and public health more effectively."<sup>3</sup>

Healthcare is one of the prime areas in which a high-speed broadband network can facilitate new models of service delivery; however, a ubiquitous and robust broadband infrastructure is necessary to fully leverage the benefits of Health IT. High-speed broadband access enables information-driven health practices that dial-up cannot provide. Broadband supports the use of Electronic Health Records (EHR), a more effective means of exchanging accurate patient information between healthcare providers. Broadband also empowers healthcare providers to deliver telemedicine services (medical diagnostic and treatment services), removing geographic and time constraints for isolated communities by enabling video consultation and patient monitoring. These technologies permit communications between patient and medical staff with both convenience and fidelity, as well as the transmission of medical, imaging and health informatics data from one site to another.



To ensure that Puerto Rico patients and the healthcare providers serving them will be able to fully leverage the benefits of Health IT, the Puerto Rico Broadband Taskforce sets the following goals and standards:

### <u>Strategic Goals for Puerto Rico - Healthcare</u>

All Puerto Rican healthcare providers and patients should have access to broadband that meets the capacity, latency, and quality of service specifications necessary to utilize healthcare information technology and provide telemedicine services effectively.

#### e-Health Goals:

- By 2015, create a nationwide e-care network that will ensure interconnectivity between all stakeholders, including patients, healthcare providers, and payers – public and private.
- By 2015, ensure broadband network capacity available to healthcare providers:
  - 4 Mbps to all healthcare providers
  - 10 Mbps to nursing homes and rural healthcare providers
  - 25 Mbps to clinics and large physician practices (5-25 physicians)
  - 100 Mbps to hospitals
- By 2020, ensure 1 Gbps to academic and large medical centers



The Healthcare sector has unique challenges. It inherently generates mountains of information, yet at the same time is duty bound to keep these mountains hidden for the sake of individual privacy. For companies charged with managing and working with this information, high-speed Internet access and technology innovations are crucial. On a daily basis, doctors must keep up with the latest research; patient records have to be easily accessible and accurate; and images, test results, and prescriptions have to be delivered promptly, without errors, to practitioners, pharmacies, and insurance providers. In healthcare, errors and delays are not only costly, but also may be hazardous to a patient's health.

There is a developing set of broadband-enabled solutions that can play an important role in the transformation of the Healthcare sector. These solutions, most often grouped under the name health information technology (Health IT), offer the potential to improve healthcare outcomes while simultaneously controlling costs, extending the reach of the limited pool of healthcare professionals, and enabling providers to better manage patient care through secure use and sharing of health information.<sup>4</sup> Furthermore, as a major area of innovation and entrepreneurial activity, the Health IT industry can serve as an engine for job creation and global competitiveness.<sup>5</sup>

Health IT includes the use of EHRs instead of paper medical records to maintain health information. Many providers are converting to EHRs which can be easily updated and shared on secure, internal networks. EHRs help ensure that appropriate medical information is available, reduces medical errors and healthcare costs, and improves coordination among healthcare facilities. As a result, EHRs will ultimately enable significant improvements in the quality of healthcare for patients and reduction of healthcare delivery costs. A keen example of the impact of EHRs on a patient's quality of life comes from the testimony of chronic patient Gregorie Stokes III regarding how the WebDMEMR EHR system has drastically improved his ability to get quality healthcare service in Puerto Rico. After more than 20 years struggling to collect and present his vast health history to new healthcare providers, Mr. Stoke reports that you can imagine my relief to finally meet a physician [in Puerto Rico] with an Electronic Medical Record capability accessible to me and my numerous physicians across the multiple systems of healthcare, public and private, inside and outside Puerto Rico.

Recognizing these potential benefits, and the need for government coordination and encouragement to make it a reality across the U.S., the Health Information Technology for Economic and Clinical Health (HITECH) Act seeks to improve American healthcare delivery and patient care through an investment in Health IT.9 The provisions of the HITECH Act are specifically designed to work together to provide the necessary assistance and technical support to providers, enable coordination and alignment within and among states, establish connectivity to the public health community in case of emergencies, and ensure that the workforce is properly trained and equipped to be meaningful users of EHRs. Combined, these programs build the foundation for every American to benefit from EHRs, as part of a modernized, interconnected, and vastly improved system of care delivery. The Office of the National Coordinator for Health Information Technology (ONC) at the Department of Human and Health Services is overseeing this process.

Two key programs of this initiative are the State Health Information Exchange Cooperative Agreement Program and the Health Information Technology Extension Program. The State Health Information Exchange Cooperative Agreement Program establishes health information exchange (HIE) capability among healthcare providers and hospitals in each state or territory. This program is designed to encourage breakthrough innovations for health information exchange that can be leveraged widely to support nationwide health information exchange and interoperability. The Health Information Technology Extension Program is a grant program to establish Health Information Technology Regional Extension Centers to offer technical assistance, guidance, and information on best practices to support and accelerate healthcare providers' efforts to become meaningful users of Electronic Health Records. Leveraging federal grant funding, the PRHIN has partnered with ONC to implement the HIE project across the island.

In addition to EHRs, broadband facilitates efficiency in healthcare delivery and creates opportunities for collaboration between doctors, healthcare specialists, and patients located anywhere in the world. Telemedicine, for example, is a term used to describe the use of medical information exchanged from one site to another via electronic communication to improve patients' health status.<sup>13</sup> Telemedicine includes network-based technologies like video-conferencing and digital stethoscopes, which allow specialists to consult with patients regardless of geographic location – reducing travel time and hazards – while test results from a hospital emergency room or laboratory can be sent to a radiologist or doctor in seconds, making rapid diagnosis a reality. Because of the increased efficiency and capability, the healthcare industry has found the perfect partner in high-speed broadband technology.<sup>14</sup>

Indeed, this technology saves lives, as exemplified by Phoenix, AZ neurologist Bart Demaerschalk and a stroke victim in a rural health clinic 200 miles away. <sup>15</sup> Within minutes of receiving an emergency call, Dr. Demaerschalk had set up a video conference, empowering him to look at the patient, ask her questions, go over her brain scan and confirm the diagnosis – all made possible by rural broadband access. Equipped with live video feed via broadband, the doctor was empowered to give the patient a much more thorough evaluation than if it was just over the phone, and ultimately made the right decision for her to be rushed to the hospital to be administered drugs.

Similar results were experienced when the Puerto Rico Department of Health conducted the 2002 telemedicine pilot study that installed a system between the municipality of Vieques and the Tertiary Centro Medico emergency and radiology department in San Juan. <sup>16</sup> By utilizing image transmission and video conferencing, the remote Vieques facility could send radiology images to be read at the San Juan facility. The project realized significant savings in patient travel expense and an increase in the turn-around time of results, especially for specialized services located only in metropolitan centers. Before, most patients requiring radiology services were escorted via helicopter to a specialist in San Juan.

From rural Arizona to remote Puerto Rico, these examples point to a major problem facing remote or isolated communities: while the nearest hospital is often many miles away, a hospital where experts can diagnose and treat specific disorders are even farther away. In these situations, experts frequently use phone calls to make judgments on patients' status; but now with advances in video technology, the potential exists for them to make much more thorough diagnoses – as long as the appropriate broadband infrastructure is in place to support the technology.<sup>17</sup>

Take Naguabo, for example. In this municipality of 26,720 residents there are only 16 doctors serving the community.<sup>18</sup> This works out to approximately 1,670 patients per doctor; compared to San Juan, where there are 119 patients for every doctor.<sup>19</sup> Broadband can help bridge the healthcare provider gap in Naguabo, a community where high-speed broadband is available

across much of the population. Connect Puerto Rico's June 2011 broadband availability analysis indicates that more than three-quarters (77%) of Naguabo's households have access to advertised broadband download speeds of at least 10 Mbps.<sup>20</sup> That available capacity can be leveraged by doctors, remote clinics, and patients to improve the quality of healthcare service in this community. Other communities across Puerto Rico have acute shortages of medical specialists and could similarly benefit from telemedicine solutions.<sup>21</sup>

## According to the 2010 Connect Puerto Rico Business Technology Assessment, 85% of the businesses in Puerto Rico's Healthcare sector subscribe to broadband.

## B. Broadband Adoption Among Healthcare Providers Across Puerto Rico

Health IT will not reach its true potential without full access to broadband services. Research remains scarce on Puerto Rico's healthcare providers' broadband connectivity needs and the ability of the island's infrastructure to meet those needs. However, in 2010, as part of the Puerto Rico Business Technology Assessment, Connect Puerto Rico surveyed businesses in the Healthcare sector to determine technology adoption levels.<sup>22</sup> The results were surprising.

According to the 2010 Connect Puerto Rico Business Technology Assessment, 85% of the businesses in Puerto Rico's Healthcare sector subscribe to broadband. In comparison, only 63% of all businesses in the Healthcare sector located in jurisdictions surveyed by Connected Nation report subscribing to broadband, a difference of 22 percentage points.<sup>23</sup> Furthermore, out of all of the industry sectors operating in Puerto Rico, the Healthcare sector reported the third highest broadband adoption rate (Figure VII.1).

Percentage of Businesses in the Healthcare Broadband Adoption by Sector with a Broadband Subscription Puerto Rico Industry Sector 85% 74% Puerto Rico Average High Tech 94% 63% Agriculture, Mining, 80% Construction, & Utilities 81% Manufacturing Wholesale, Warehouse, 67% & Transportation 64% Retail & Hospitality Professional & Financial 89% 85% Connected Nation Puerto Rico Healthcare Average Other Services 67%

Figure VII.1 - Broadband Adoption in the Healthcare Sector

This data indicates that Puerto Rico healthcare providers are subscribing to broadband at higher rates than their counterparts in other U.S. jurisdictions surveyed by Connected Nation. This is a positive outcome. It may well be driven by the relatively large degree of patients in Puerto Rico who qualify for Medicare or Medicaid coverage, and the need for electronic billing under these programs. That being said, as data presented in the next segment indicates, the broadband speeds that these healthcare providers receive is significantly below what their counterparts elsewhere receive and significantly below standards needed to support new Health IT services. The broadband speeds available to the majority of healthcare providers are insufficient to sustain many Health IT solutions, indicating that, while broadband penetration is high in the Puerto Rico Healthcare sector, it is not being fully leveraged to unleash the full benefits of Health IT.

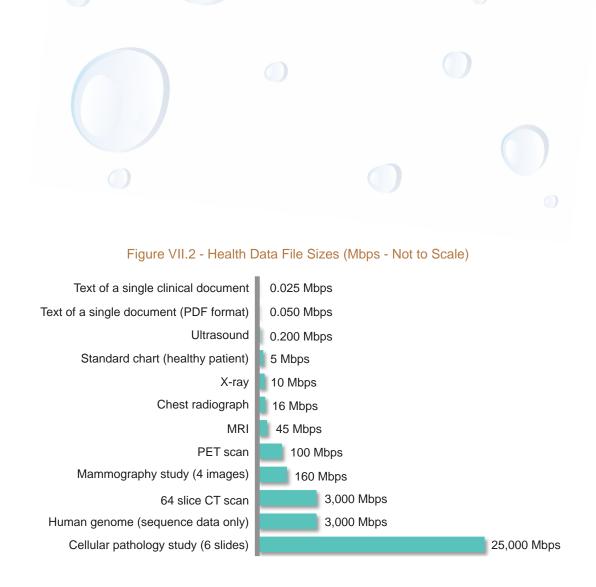
### 1. The Healthcare Sector's Broadband Capacity Needs

Having access to broadband is not sufficient to ensure that healthcare providers can fully leverage the benefits of Health IT innovations. It is essential that access be of sufficient capacity to enable the real-time high-capacity necessary to support Health IT solutions. Healthcare providers' broadband needs are largely driven by the rapidly increasing amount of digital health-related data that is collected and exchanged. Although some delivery settings currently function at lower connectivity and quality, those levels are straining under increasing demand and are unable to support needs likely to emerge in the near future. But how fast is fast enough?

A single video consultation session can require a minimum of a symmetric 2 Mbps connection with a good quality of service.<sup>24</sup> There is a wide range of requirements to support EHRs and

medical imaging, and over the next decade, physicians will need to exchange increasingly large files as new technologies such as 3D imaging become more prevalent; stimulating demand for more and better broadband, because these applications have specific requirements for network speeds, delay, and jitter.<sup>25</sup> Figure VII.2 provides examples of file sizes for different types of health data file types that healthcare providers may encounter.<sup>26</sup>





Health IT infrastructure must meet current demands of the healthcare provider as well as grow to meet its future needs. The connectivity needs of different health delivery settings vary depending on their type (e.g., tertiary care center versus primary care physician practice) and their size.<sup>27</sup> Figure VII.3 shows an estimate of the required minimum connectivity and quality metrics to support deployment of Health IT applications today and in the near future at different types of health delivery settings.<sup>28</sup>

Figure VII.3 - Recommended Bandwidth Speeds By Location Category (Mbps - Not to Scale) Small Physician Practice 4 Mbps Small Primary Care Practice (2-4 physicians) 10 Mbps Nursing Home 10 Mbps Rural Health Center (≈ 5 Physicians) 10 Mbps Clinic/Large Physician Practice 25 Mbps (5-25 physicians) 100 Mbps Hospital 1,000 Mbps Academic/Large Medical Center



There is little doubt that Health IT initiatives such as EHR, e-prescribing, telemedicine, and health monitoring have the potential to offer tremendously improved quality of care – as well as significant cost savings – in the delivery of care for providers and patients alike. However, based on the suggested bandwidth requirements listed in Figure VII.2 and Figure VII.3, Puerto Rico's Healthcare sector faces a broadband connectivity gap (Figure VII.4).

The 2010 Connect Puerto Rico Business Technology Assessment indicates that the average advertised download speed reported among businesses in the Healthcare sector is 2.6 Mbps, significantly lower than the 8.6 Mbps average reported by businesses in the Healthcare sector located in jurisdictions surveyed by Connected Nation in 2010. Furthermore, among Puerto Rico's business sectors, the Healthcare sector reported slower speeds than any sector (Figure VII.4). This lack of adequate infrastructure could prevent Puerto Rico's health workers from delivering healthcare efficiently.

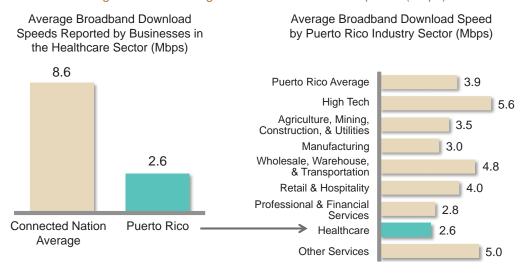
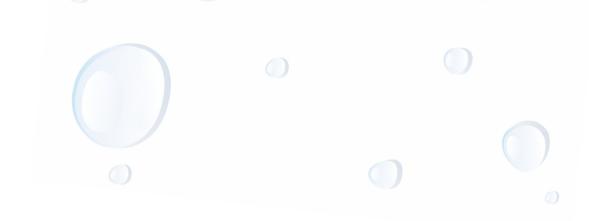


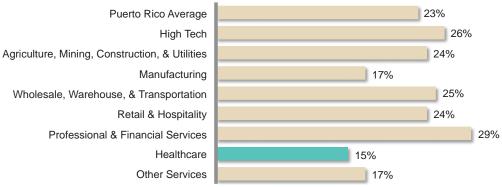
Figure VII.4 - Average Broadband Download Speeds (Mbps)

Understanding the state of broadband access and connectivity for the Healthcare sector is a new but important area of analysis, especially as the need for better data continues to grow. Of particular importance for both Internet providers and policy makers is the ability to understand consumer demand and satisfaction with their broadband subscription. Businesses in Puerto Rico's Healthcare sector present an interesting case study.



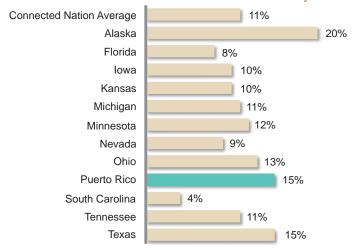
When asked if their business could use more bandwidth, only 15% of businesses in Puerto Rico's Healthcare sector reported that they did, despite their low bandwidth (Figure VII.5). At first glance, this statistic appears to indicate a perceived lack of need, especially when compared to other industry sectors in Puerto Rico.

Figure VII.5 - Percent of Puerto Rico Broadband-Connected Businesses That Say They Need More Bandwidth by Industry Sector



However, Connected Nation's 2010 research in eleven states reveals that, in general, the Healthcare sector reports low levels of need for increased bandwidth, and the Puerto Rico Healthcare sector actually ranks near the top of the list in terms of needing more bandwidth (Figure VII.6).

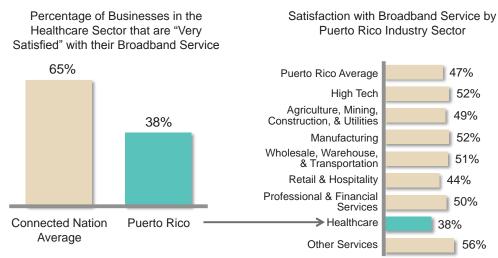
Figure VII.6 - Percent of Broadband-Connected Businesses in the Healthcare Sector That Need More Bandwidth by Location





In addition to asking businesses about their perceived need for more bandwidth, Connect Puerto Rico inquired upon business satisfaction regarding their broadband service. As figure VII.7 shows, just 38% of Puerto Rico businesses in the Healthcare sector report being "Very Satisfied" with their broadband service, compared to nearly two-thirds (65%) of all businesses in the Healthcare sector surveyed by Connected Nation in 2010. Furthermore, within Puerto Rico, the Healthcare sector reports the lowest level of broadband service satisfaction (Figure VII.7).

Figure VII.7 - Percent of Broadband-Connected Businesses That Say They Are "Very Satisfied" With Their Broadband Service

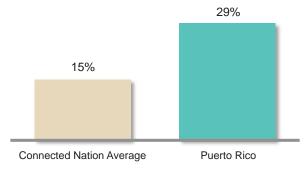


Puerto Rico's Healthcare sector is characterized by high levels of broadband adoption, a lack of perceived need for increased bandwidth, and a low level of broadband service satisfaction. While conflicting in nature, this data may indicate a lack of industry experience with broadband applications, especially when it comes to the infrastructural needs of Health IT applications.

Perhaps supporting these findings is the comparatively short amount of time that businesses in Puerto Rico's Healthcare sector have been online. Connect Puerto Rico's findings indicate that 29% of broadband-connected businesses in Puerto Rico's Healthcare sector report first subscribing to broadband two years or less prior to the survey taking place (August 2010). In comparison, only 15% of all businesses surveyed by Connected Nation report subscribing to broadband for two years or less, indicating that these businesses have much more experience utilizing broadband (Figure VII. 8).

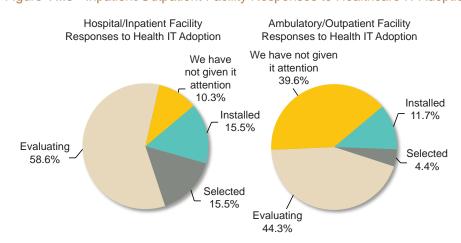


Figure VII.8 - Percent of Broadband-Connected Businesses in the Healthcare Sector That Have Been Using Broadband for Two Years or Less



Indeed, the Strategic Plan of the Puerto Rico Health Information Network confirms the conclusion that the Healthcare sector lacks sufficient experience in utilizing Health IT applications.<sup>29</sup> According to the research presented in the Plan, it wasn't until mid-2010 that local vendors and developers of Health IT applications began to heavily promote their offerings. In 2010, as part of their responsibilities under the State Health Information Exchange Cooperative Agreement Program, the Puerto Rico Health Information Network also conducted a survey in order to identify the status of interoperable Health IT adoption on the island. While the vast majority of respondents reported having some form of broadband in their workplace, survey results evidenced a general lack of awareness about national health information exchange initiatives. Furthermore, it was found that the number of providers and organizations, inpatient and ambulatory, who have selected and installed a Health IT solution are largely a minority. According to the survey, while approximately 59% of inpatient facilities were evaluating Health IT options, less than one-third of inpatient facilities had selected or installed a Health IT solution (Figure V.II 9). Among outpatient facilities, nearly two-fifths had not even given any attention to Health IT applications.



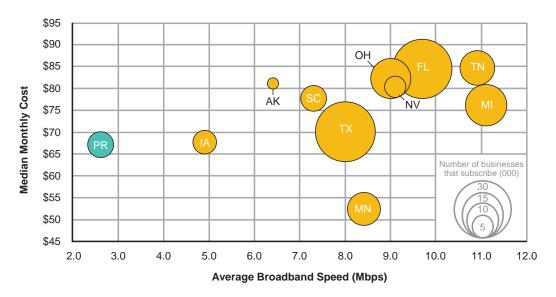




### 3. The Need for Increased Capacity

For the benefits of Health IT solutions to be realized, meaningful use of these applications must be attained. However, adequate infrastructure required for Health IT applications is first needed. According to the FCC's National Broadband Plan, smaller providers can achieve satisfactory Health IT adoption with a download speed of at least 4 Mbps for single physician practices and 10 Mbps for two-to-four physician practices, even though these solutions may not provide business-grade quality-of-service guarantees. Based on this requirement, Puerto Rico definitely faces a connectivity gap. As Figure VII.10 indicates, although businesses in Puerto Rico's Healthcare sector pay a similar monthly price for broadband service, the average advertised speed is significantly lower; and at 2.6 Mbps, hardly fast enough to support current Health IT applications.



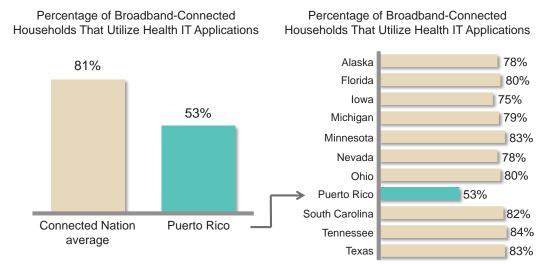


Furthermore, Connect Puerto Rico's 2010 Residential Technology Assessment appears to confirm that Puerto Rico's Healthcare sector is straining under the current capacity (Figure VII.11).<sup>31</sup> Among the 31% of Puerto Rico residents with a home broadband subscription, 53%, (or approximately 485,000 residents) utilize their broadband subscriptions to access Health IT applications. This includes 49% who access health or medical information, 10% who communicate with their health insurance company, and 11% who communicate with their doctors or other healthcare professionals.



In comparison, among all jurisdictions surveyed by Connected Nation in 2010, 81% of broadband-connected households utilize their connection to access Health IT applications.<sup>32</sup> This includes 73% who search for health or medical information, 41% who communicate with their health insurance company, and 34% who communicate with their doctors or other healthcare professionals.

Figure VII.11 - The Percentage of Broadband-Connected Households that Utilize Health IT Applications



Thus, in regards to Puerto Rico's broadband infrastructure for the Healthcare sector, three gaps remain: education, adequate infrastructure, and utilization. Proper education and awareness measures need to be taken in order to encourage adoption of Health IT applications in the Healthcare sector. Furthermore, Puerto Rico's bandwidth constraints are preventing healthcare providers from achieving full utilization of video consultation, remote image diagnostic, and EHR technology. These gaps must be filled to accelerate the benefits of broadband and to support needs likely to emerge in the near future.

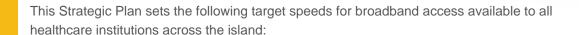


The previous section describes the state of broadband adoption and usage across Puerto Rico healthcare providers and identifies significant gaps in broadband infrastructure serving the healthcare community and Health IT usage that remain a challenge in Puerto Rico. Available data indicates that Puerto Rico healthcare providers are lagging behind in the adoption of Health IT solutions, and that the broadband capacity serving them today is drastically insufficient to support increasingly available Health IT solutions. Consumers and patients, on the other hand, are also lagging behind the adoption and usage of broadband technology that will ultimately enable, among other things, full leverage of these Health IT solutions to ensure better healthcare and, ultimately, higher quality of life.

It is imperative that this gap be closed – and fast. Health IT is in its infancy. As emerging Health IT applications become more prevalent and the importance of bandwidth capacity grows, it will be critical that Puerto Rico's healthcare providers have the infrastructure that they need. In this section we outline a series of strategies that will help achieve these goals across Puerto Rico. Building upon the experience of the PRHIN and other healthcare IT experts, this section analyzes the key challenges preventing full penetration of Health IT solution across Puerto Rico, and proposes a series of strategies to overcome these challenges.

# 1. Drastically Enhance Broadband Capacity Available to Healthcare Providers

Chapter 3 of this Strategic Plan outlines in detail the state of Puerto Rico's broadband infrastructure, and identifies a significant broadband access gap across the island. Data presented in this chapter indicates that this gap is affecting the ability of healthcare providers to fully leverage Health IT opportunities. It is imperative that the access gap be closed across the island to serve all citizens and institutions and, in particular, to provide access via robust speeds for healthcare providers. Elsewhere in this Strategic Plan we discuss the challenges and strategies to promote increased investment in broadband capacity. We do not reiterate those strategies here, but do emphasize that serving the broadband needs of hospitals, clinics, laboratories, diagnostic centers, and payers into the system is imperative for Puerto Rico to contain the costs of healthcare delivery and improve health statistics across the island.



#### Strategic Goals for Puerto Rico - Healthcare

All Puerto Rican healthcare providers and patients should have access to broadband that meets the capacity, latency, and quality of service specifications necessary to utilize healthcare information technology and provide telemedicine services effectively.

#### e-Health Goals:

- By 2015, create a nationwide e-care network that will ensure interconnectivity between all stakeholders, including patients, healthcare providers, and payers – public and private.
- By 2015, ensure broadband network capacity available to healthcare providers:
  - 4 Mbps to all healthcare providers
  - 10 Mbps to nursing homes and rural healthcare providers
  - 25 Mbps to clinics and large physician practices (5-25 physicians)
  - 100 Mbps to hospitals
- By 2020, ensure 1 Gbps to academic and large medical centers

As broadband providers continue investing in broadband capacity to meet these goals, more data will be necessary to assess the level of connectivity available to healthcare providers. Part of the broadband mapping efforts undertaken by the Office of the CIO include the collection of data documenting the type and speeds of broadband contracted by community anchor institutions, including healthcare providers. To ensure comprehensive, up to date information, it is imperative that healthcare providers actively cooperate with this initiative, which aims to understand the current state of broadband use across the industry and assess development as broadband services are expanded. To do so, all healthcare providers are invited to provide data about their broadband connectivity by submitting an online survey available at <a href="http://www.connectpr.org/policy">http://www.connectpr.org/policy</a>

#### Recommendation:

Continue ongoing efforts to document information regarding broadband service capacity used by healthcare providers across Puerto Rico.



Data indicates that a large percentage of Puerto Rico healthcare providers are lagging behind in the adoption and usage of Health IT solutions. It is imperative that the gap be closed to ensure a viable Healthcare sector and to meet federal requirements for continued funding under various programs.

Barriers to Health IT adoption and the broadband capacity necessary to sustain these solutions include financial constraints as well as lack of perceived need. These two factors, affordability and relevance, are in fact inherently one and the same. Healthcare providers that don't appreciate the efficiencies enabled by Health IT solutions are less willing to invest in the IT systems and broadband capacity necessary to sustain them. In short, too many healthcare providers across Puerto Rico still don't see these expenses as investments that will rapidly result in lower overall costs of healthcare delivery.

To overcome the lack of perceived relevance, the PRHIN and, in particular, the Regional Extension Centers, has launched awareness campaigns aimed to educate healthcare providers about the benefits of these tools and the potential funding consequences of not adopting solutions such as capacity to manage Electronic Health Records. The Puerto Rico Broadband Taskforce believes these outreach efforts are essential and recommends that resources be allocated to continue funding such efforts.

#### **Recommendation:**

Overcome the usage lag of Health IT solutions by Puerto Rico healthcare providers. Continue allocating resources to awareness campaigns aimed at educating healthcare providers about the benefits of Health IT.

3. Reinforce Public-Private Partnerships to Overcome Governmental Barriers to Health IT Expansion

Ensuring a vibrant Healthcare sector is a core objective of the Government of Puerto Rico. The current Government and the Puerto Rico Legislature have made significant accomplishments in promoting and expanding Health IT solutions across Puerto Rico. Key milestones include the establishment of the Puerto Rico HIT Coordinator, and the PRHIN, and the office of the Chief Medical Information Officer (CMIO) within the Department of Health. In 2011, the first HIE/HIT legislation was signed into law, enabling the PRHIN to begin to release technical and educational materials aimed to integrate healthcare information processes across the region and defining the role of PRHIN as a key one-stop source of HIE/HIT governance in Puerto Rico.

Much work has been done to date, but much work remains to ensure the ability to overcome legal and institutional stumbling blocks in the sector. One example includes the need for legal clarity regarding privacy law as it affects a patient's healthcare records. This is a challenge that all nations are facing as a result of the Health IT transformation underway. The legal precedent that exists is typically insufficient to offer clear and robust guidelines on how this information can and cannot be used. Rapid approval of legislation that will clearly define and ensure the privacy rights of patients to their health information is essential to ensure the rapid unleashing of solutions such as EHRs. Patients, healthcare providers, insurance and payer systems need clear legal guidelines of how information will be used, processed, and protected in order to ensure a functional system.

Overcoming these legal barriers will not only crucially help to promote the penetration of Health IT solutions, such as EHR, it will also help solidify a sound broadband policy for Puerto Rico. As healthcare providers increasingly use these IT solutions, demand from a key sector consuming high-capacity broadband will expand, significantly contributing to the overall sustainability of the sector. Such increased demand will, in turn, affect the economics of broadband built-out to offer ever more robust and fast networks. As in any market, as demand grows and is sustained, supply follows.

To accelerate the penetration of Health IT solutions across the Puerto Rico health system, private and public stakeholders should work to establish pilot programs offering telemedicine services across remote areas of Puerto Rico. Two such pilots could be radially implemented in Vieques and Culebra. A telemedicine pilot program providing remote medical assistance from the San Juan Medical Center to citizens of Vieques and Culebra could offer immediate benefits to thousands of citizens currently underserved by healthcare services and help healthcare providers, public institutions, payer systems, and patients learn how best to implement and benefit from such remote e-Health solutions.

Hence, while promoting Health IT solutions is not the core objective of this Strategic Plan, the Puerto Rico Broadband Taskforce stands in support of the efforts of the Puerto Rico HIT Coordinator and the PRHIN as they strive to overcome legislative and governmental barriers to full implementation of HIE and HIT resources.

#### **Recommendation:**

Reinforce public-private partnerships to overcome governmental barriers to Health IT expansion.



## Endnotes

- <sup>1</sup> Office of the Governor of Puerto Rico, Puerto Rico Health Information Network. (2012). *Puerto Rico health information exchange Strategic Plan*. Retrieved from website: <a href="http://dl.dropbox.com/u/19109234/SOP 2">http://dl.dropbox.com/u/19109234/SOP 2</a> of 3/PRHIESOP Strategic Plan v1.02.pdf
- <sup>2</sup> Ibid.
- <sup>3</sup> Federal Communications Commission. (2010). *National Broadband Plan*, p. 200. Retrieved from website: <a href="http://www.broadband.gov/plan/10-healthcare/">http://www.broadband.gov/plan/10-healthcare/</a>
- <sup>4</sup> U.S. Department of Health & Human Services, The Office of the National Coordinator for Health Information Technology. (2011). *Why Health IT?*. Retrieved from website: <a href="http://healthit.hhs.gov/portal/server.pt/community/healthit\_hhs\_gov/heme/1204">http://healthit.hhs.gov/portal/server.pt/community/healthit\_hhs\_gov/heme/1204</a>
- <sup>5</sup> Federal Communications Commission. (2010). *National Broadband Plan*, p. 199. Retrieved from website: <a href="http://www.broadband.gov/plan/10-healthcare/">http://www.broadband.gov/plan/10-healthcare/</a>
- <sup>6</sup> Martin, K. Federal Communications Commission, (2007). *17th meeting of the american health information community (ahic)*. Retrieved from website: <a href="http://hraunfoss.fcc.gov/edocs-public/attachmatch/DOC-278126A2.pdf">http://hraunfoss.fcc.gov/edocs-public/attachmatch/DOC-278126A2.pdf</a>
- <sup>7</sup> WebDMEMR is an abbreviation for "Web Based Disease Management Electronic Medical Record."
  An electronic medical record (EMR) is an application used by healthcare providers to store, organize, and access all patients' clinical data from a particular hospital or practice. An electronic health record (EHR) is a patient centric application where long-term and aggregate health information from one or more encounters in any healthcare delivery setting is stored. In contrast to an EMR, which only stores data from a particular hospital or practice, and EHR allows a patient to store data from any healthcare delivery encounter. WebDMEMR is a web-based application that enables both EMR and EHR functionality for any location in the world, provided an Internet connection is available. WebDMER's EHR function enables patients to share past data with the physicians of their choice. For more information, visit: <a href="http://webdmemr.com/default.aspx">http://webdmemr.com/default.aspx</a>
- <sup>8</sup> Testimonial of Mr. Gregorie Stoke, "Client recommendation for American Telemedicine President, staff and WebDMEMR."
- <sup>9</sup> U.S. Department of Health & Human Services, The Office of the National Coordinator for Health Information Technology. (2011). *Hitech programs*. Retrieved from website: <a href="http://healthit.hhs.gov/portal/server.pt/community/healthit.hhs.gov/portal/server.pt/community/healthit.hhs.gov/hitech\_programs/1487">http://healthit.hhs.gov/portal/server.pt/community/healthit.hhs.gov/hitech\_programs/1487</a>
- 10 Ibid.
- "U.S. Department of Health & Human Services, The Office of the National Coordinator for Health Information Technology. (2012). State health information exchange cooperative agreement program. Retrieved from website: <a href="http://healthit.hhs.gov/portal/server.pt?open=512&objID=1488&parentname=CommunityPage&parentid=58&mode=2&in\_hi\_userid=11113&cached=true">http://healthit.hhs.gov/portal/server.pt?open=512&objID=1488&parentname=CommunityPage&parentid=58&mode=2&in\_hi\_userid=11113&cached=true</a>
- <sup>12</sup> U.S. Department of Health & Human Services, The Office of the National Coordinator for Health Information Technology. (2010). *Health information technology extension program*. Retrieved from website: <a href="http://www.healthit.hhs.gov/portal/server.pt?open=512&objlD=1335&mode=2">http://www.healthit.hhs.gov/portal/server.pt?open=512&objlD=1335&mode=2</a>
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<sup>15</sup> Painter, K. (2009, February 15). Diagnosis by 'telemedicine' can save stroke victims. *USA Today*. Retrieved from <a href="http://www.usatoday.com/news/health/painter/2009-02-15-your-health">http://www.usatoday.com/news/health/painter/2009-02-15-your-health</a> N.htm



- <sup>16</sup> Valentin, O. Puerto Rico Health Department, Informatics Office. *Puerto Rico rural health care pilot program*. Retrieved from website: http://apps.fcc.gov/ecfs/document/view?id=6519409778
- <sup>17</sup> [Web log message]. (2009, February 02). Retrieved from http://www.speedmatters.org/blog/archive/rural-broadband
- 18 Puerto Rico Health Information Network, (2011). Physicians report by city in Puerto Rico
- 19 Ibid.
- <sup>20</sup> Per Connect Puerto Rico's June 2011 NTIA submission.
- <sup>21</sup> Puerto Rico Health Information Network, (2011). Physicians report by city in Puerto Rico Note: Fifteen of Puerto Rico's 78 município's are served by less than twenty doctors, making travel to specialists at hospitals in other regions often necessary.
- <sup>22</sup> Connect Puerto Rico, (2010). *Connect Puerto Rico business technology assessment results*. Retrieved from website: <a href="http://www.connectpr.org/survey-results/business">http://www.connectpr.org/survey-results/business</a>

Note: In 2010, Connect Puerto Rico conducted the Business Technology Assessment, a random digit dial phone survey of 814 Puerto Rican businesses. This provides a margin of error for the territory-wide sample of  $\pm 5.1\%$ .

<sup>23</sup> Connected Nation, (2011). *Broadband and business: Leveraging technology to stimulate economic growth.* Retrieved from website: <a href="http://www.connectednation.org/sites/default/files/broadband\_and\_business">http://www.connectednation.org/sites/default/files/broadband\_and\_business</a> - connected\_nation.pdf

Note: In 2010, Connected Nation conducted a series of random digital dial phone surveys of 9,650 businesses in 11 U.S. states (Alaska, Florida, Iowa, Kansas, Michigan, Minnesota, Nevada, Ohio, South Carolina, Tennessee, and Texas) and Puerto Rico. This provides a margin of error for the entire sample of  $\pm 1.6\%$ .

<sup>24</sup> Letter from Chuck Parker, Executive Director, Continua Health Alliance, to Marlene H. Dortch, Secretary, FCC, GN Docket Nos. 09-57, 09-51 (Nov. 16, 2009) (Continua Nov. 16, 2009 Ex Parte) Attach. at 13. Retrieved from website: <a href="http://fjallfoss.fcc.gov/ecfs/document/view?id=7020348541">http://fjallfoss.fcc.gov/ecfs/document/view?id=7020348541</a>

Note: Bandwidth thresholds are actual (i.e., not advertised) speeds.

- <sup>25</sup> Federal Communications Commission. (2010). *National Broadband Plan*, p. 211. Retrieved from website: <a href="http://www.broadband.gov/plan/10-healthcare/">http://www.broadband.gov/plan/10-healthcare/</a>
- <sup>26</sup> Federal Communications Commission. (2010). *National Broadband Plan*, p. 210. Retrieved from website: <a href="http://www.broadband.gov/plan/10-healthcare/">http://www.broadband.gov/plan/10-healthcare/</a>
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- <sup>28</sup> Ibid.

Note: Mbps recommendations reflect compilation of the record. Numbers are guidelines, not precise measures.

- <sup>29</sup> Office of the Governor of Puerto Rico, Puerto Rico Health Information Network. (2012). *Puerto Rico health information exchange Strategic Plan*. Retrieved from website: <a href="http://dl.dropbox.com/u/19109234/SOP 2">http://dl.dropbox.com/u/19109234/SOP 2</a> of 3/PRHIESOP Strategic Plan v1.02.pdf
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  Note: The 2010 Puerto Rico Residential Technology Assessment consisted of a random digital dial survey (RDD) of 1,200 Puerto Rico households.

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<sup>&</sup>lt;sup>32</sup> Connected Nation, 2010. Connected nation consumer adoption trends. Retrieved from website: <a href="http://www.connectednation.org/survey-results/residential">http://www.connectednation.org/survey-results/residential</a>

Note: Connected Nation Average data comes from similar phone surveys conducted in thirteen jurisdictions served by Connected Nation in 2010. Connected Nation conducted random digit dial (RDD) telephone surveys of 15,647 adults age 18 and older living in Alaska, Florida, Illinois, Iowa, Kansas, Michigan, Minnesota, Nevada, Ohio, Puerto Rico, South Carolina, Tennessee, and Texas. These surveys were designed to measure technology adoption, how individuals use technology, and barriers to technology adoption among adults.







